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The Revolving MOONS.

PART I.

Where the Motions in : and of : the Lunar Syſtem, cauſing the various apparent Inequalities in the Moon's Revolations, rationally, and circumſtantially are explained, and illuſtrated by proper Figures. Derived from the two Celebrated Aſtronomers Mr. Flamſteed's, *and Dr.* Halley's *Lunar Obſervations.*

The Motions concerning the Moon are (1) which ſingly have reſpect to the Lunar Syſtem, and (2) which have Reſpect to the Ecliptic

§ I. IF we endeavour to give a rational Idea of the Motions whereby the apparent Inequalities in the Revolutions of the Moon can be explained, we are to conſider them (1) *So far as they ſingly have Reſpect to the Lunar Syſtem*; and (2) *So far as they have Reſpect to the Ecliptic.*

(I.) The Motions which ſingly have Reſpect to the Lunar Syſtem are in : and of : the Syſtem.

§ II. As for theſe, *which ſingly have Reſpect to the Lunar Syſtem*, we are to conſider firſt *the Motions in* : and further *the Motions of* : *the Lunar Syſtem.*

(a) The Motions in the Lunar Syſtem deſcribe two Curves.

§ III. The Motions in the Lunar Syſtem deſcribe *two Curves*, compoſing the Syſtem, *both in one and the ſame Plane*, viz. *The very Motion of the Moon deſcribes one Curve*; and *the Center of the Curve, deſcribed by the Moon, another.*

The Curve Lunaris.

§ IV. *The very Motion of the Moon*, deſcribes a Curve round the Earth, *it being an Ellipſis, whoſe Center is not in : but excentric from : the Earth.* This Curve, (in the firſt Figure b. b. b. b.), I call LUNARIS, (from the Moon, deſcribing the ſame).

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§ V. *The Motion of the Center of the Lunaris* deſcribes another Curve round the Earth, *it being an Ellipſis, whoſe Center is in the Earth.* This Curve, (in the firſt Figure a. a. a.) I call GEOCENTRICA, (from the Earth in the Center.)

The Curve Geocentrica.

§ VI. I draw *a Right-Line from the Center of the Earth's Orbit through the Earth*, it being *the Center of the Lunar Syſtem* (in the firſt Figure from S. through E). and drawing another Right-Line through the Lunar Syſtem, paſſing its Center, and coinciding with the firſt ſaid Right-Line, I call the LUNAR SYSTEM's DIAMETRAL-LINE; in the firſt Figure D. L.

The Lunar Syſtem's Diametral Line.

The Poſitions of the Geocentric, and the Lunaris.

§ VII. By this Diametral Line, I deſcribe the Poſitions of the two ſaid Curves thus; that *the greater Axis of the Geocentric is always and conſtantly in the Diametral Line*, and *the leſſer Axis of the Lunaris always, and conſtantly, either parallel to : or co-incident with : the greater Axis of the Geocentric.*

The Moon's Apogee, and Excentricity depend on the Center of the Lunaris.

§ VIII. From the two ſaid Curves we may rationally explain *the Moon's Apogee*, and the *Excentricity*; becauſe the Center of the Lunaris is that, upon which both depend. For, drawing a Right-Line from the Center of the Geocentric *through* the Center of the Lunaris, this Right-Line cauſes *the Moon's Apogee*; (in the firſt Figure from E thro' Ap.) Therefore, the Center of the Lunaris is to be conſidered to move, as the Apogee, or rather, *the Apogee is to be conſidered to move by the Motion of the Center of the Lunaris.*

Why the Apogee.

§ IX. And again, the Right-Line from the Center of the Geocentric *to* the Center of the Lunaris expreſſes *the Excentricity*, (in the firſt Figure from E to Ap.) Therefore *the Excentricity is to be conſidered to alter by the Motion of the Center of the Lunaris in the Geocentric.*

Why the Excentricity.

It appears from the Figure, that the Excentricity has another Signification in the Moon's Theory, than in the Theories of the Primary Planets. In theſe it ſignifies the Diſtance of the Focus, wherein the Sun is, from the Center of the Elliptical Orbit; but concerning the Moon, it ſignifies the Diſtance of the Center of the Curve, deſcribed by the Moon, from the Center of the Geocentric, or the Earth.

§ X. Concerning *the Motions, which deſcribe the two ſaid Curves*, theſe are *Elliptical* in ſuch a Manner, that *they deſcribe in equal Times equal Area's, conſidering the Area's from the Centers of the Ellipſis's.*

The Motions, deſcribing the Curves.

§ XI. And here we have a *mean Idea* of the Motions in : and of the Poſition of : the Lunar Syſtem ; I ſay *a mean Idea*, (uſing the Word *mean* here, and often hereafter, in Contradiſtinction of the Word *true* ; as we do in other Caſes, ſaying for Example, the Sun's and the Moon's *mean* Motion, in Contradiſtinction of their *true* Motions); becauſe, it will appear in the following Pages, that Notice is to be taken of other Circumſtances, if we will have *the true Idea.*

Hitherto the mean Idea.

Mean, what is meant by this.

§ XII. I have ſaid in the foregoing 4th §. that *the Moon deſcribes a Curve, it being an Ellipſis*, which I called *Lunaris.* But this Lunaris cannot be conſidered otherwiſe to be the Curve for the Moon's Revolution, but *in a mean Meaning* ; becauſe *the Moon deviates within, and without the ſame.*

(1.) The Moon deviates within : and without : the Lunaris.

§ XIII. I find theſe Deviations *by Aid of an imaginary Elliptical Epicycle* placing its Center in the Lunaris, where the Moon would be in the ſame by her Elliptical Motion, (ſuch, as deſcribed in the 10th §.) ſuppoſing its Poſition in this Manner that its greater Axis is in a Right Line from the Center of the Lunaris, through the Center of the Epicycle. Where I call *the Epicycles Apſis* that point in the Epicycle, which is interſected by the ſaid Right-Line, after having paſſed the Epicycle's Center.

Theſe Deviations explained by an imaginary Epicycle

§ XIV. Now, I ſuppoſe from Obſervations, *the Moon's mean Elongation* (*) *from the ſaid Apſis in Antecedentia to be double, to what the Elongation of the Moon's mean Longitude from the mean Apogee is in conſequentia.* Wherefore *doubling the Elongation of the Moon's mean Longitude from the mean Apogee*, it gives *the mean Elongation of the Moon from the Epicycles Apſis in Antecedentia.*

(*) I have choſen the Term of *Elongation*, in expreſſing an Arch, deſcribed by a moving Body or moving Point, counting from a certain Point, or from another moving Body; to have a Word applicable every where, ſaying; the Elongation of the Earth's mean Longitude from its Aphelion, in Place for the Earth's Anomaly, *&c.*

§ XV. But, ſuppoſing the imaginary Motion of the Moon in the Epicycle to be an Elliptical one, ſuch as deſcribed in the foregoing 10th §, the Equation for ſuch is to be obſerved, if we deſire to have the equated Elongation from the Apſis.

§ XVI. If we place *the Center of the Epicycle in the Lunaris*, according to the 13th §; and *the Moon in the imaginary Epicycle*, according to the 14th and 15th §s, it will appear, *when and how ſhe deviates within : and without : the Lunaris ; and when and how ſhe antecedes or follows that Point in the Lunaris, aſſigned to her by her Elliptical Motion, and expreſſed by the Epicycle's Center.*

§ XVII. The Matter will be more plain by the ſecond Figure, where *the lineated Curve repreſents the Lunaris.* I ſhall not trouble my ſelf here with any Equation, concerning the Moon's Elliptical Motion (*either in the Lunaris or in the Epicycle*); becauſe, it is not poſſible to expreſs in the Figure the Difference between the Mean, and the Elliptical Motion.

§ XVIII. The Axis α. ε. is the leſſer Axis, which in the Figure is repreſented, as being in the Right-Line from the Center of the Earth's Orbit through the Earth. S. ε. α.

Pericenters.

§ XIX. The leſſer Axis being in the ſaid Right-Line, the Pericenters are alſo in the ſame Line, (I call *Pericenters, in Ellipſis's thoſe Points, which are interſected by the leſſer Axis*) ; and the one of the Pericenters being remoter from the Sun, than the other, I call that, what is remoteſt, *Pericentrum Aphelium.*

§ XX. This Pericentrum Aphelium I take for *terminus a quo* ; counting from thence the Elongation of the Moon in conſequentia.

§ XXI. Now ſuppoſe, that the Earth is in its mean Place, *the Pericentrum Aphelium of the Lunaris*, (being in the ſaid Right-Line), *muſt coincide with the mean Longitude of the Earth.*

§ XXII. Let *the mean Longitude of the Moon be in Conjunction with the mean Longitude of the Earth*; then the Moon muſt be in the Pericentrum Aphelium of the Lunaris. Therefore I place there the Epicycle's Center, as ſhewn by the Right-Line from the Center of the Lunaris through α, and the Apſis muſt be in the ſame Right-Line, according to the 13*th* §.

§ XXIII. Let *the Moon's mean Apogee be alſo in Conjunction with the mean Longitude of the Earth.*

§ XXIV. Now it is ſuppoſed in the 14*th* §, that, *doubling the Elongation of the Moon's mean Longitude from the mean Apogee*, it gives, *the Elongation of the Moon from the Apſis in Antecedentia.* But, the Elongation of the Moon's mean Longitude from the Moon's mean Apogee is nothing, (becauſe *the mean Longitude of the Moon*, and *the mean Apogee* being in Conjunction with the mean Longitude of the Earth, *they muſt alſo be in Conjunction with one another*), and nothing doubled gives nothing Therefore, the Elongation of the Moon from the Apſis is nothing, conſequently *the Moon will appear not diſtant from, but in the Apſis of the Epicycle*; as marked with the Spot.

§ XXV. Let the Longitude of the Moon have advanced, from the Pericentrum Aphelium of the Lunaris in conſequentia, unto where the Epicycle is placed, ſhewn by the Right-Line from the Center of the Lunaris through β, and ſuppoſe it to be 45 Degrees.

§ XXVI. In the mean while, that the mean Longitude of the Moon advances theſe 45 Degrees from the mean Longitude of the Earth, in conſequentia, the mean Longitude of the Earth has advanced from the mean Apogee about 3 Degrees $13\frac{1}{4}$ Minutes; whereſore, *the Elongation of the mean Longitude of the Moon from the mean Apogee is* 48 *Degrees* $13\frac{1}{4}$ *Minutes, in conſequentia*.

§ XXVII. Doubling this, *the Elongation of the Moon from the Apſis will be about 96 Degrees 26½ Minutes, in antecedentia*; as marked with the Spot.

§ XXVIII. If we will go on in the ſame Manner, placing the Epicycle's Center, other 45 Degrees, and again other 45 Degrees, &c. from the Pericentrum Aphelium of the Lunaris, the Moon will appear.

In the imaginary Epicycle, ſhewn by the Right Line from the Center of the Lunaris through γ, from its Apſis about 192° 53′, in antecedentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Lunaris through δ, from its Apſis about 289° 19′½, in antecedentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Lunaris through ε, from its Apſis about 25° 46′, in antecedentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Lunaris thro ζ, from its Apſis about 122° 12′½, in antecedentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Lunaris through η, from its Apſis about 218° 39′, in antecedentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Lunaris through θ, from its Apſis about 315° 5′½, in antecedentia; as marked with the Spot.

In the imaginary Epicycle, from which we did begin, and ſhewn by the Right-Line from the Center of the Lunaris through α, the Moon is not again in the Apſis, but from thence about 51° 32′ in antecedentia; as marked with the Spot.

§ XXIX. Bringing the Spots in the Epicycles, where the Moon is ſuppoſed to appear, in one Curve, *the Moon in the ſuppoſed Revolution would have deſcribed the pointed Curve*, deviating within : and without : the Lunaris; and anteceding and following the Points, aſſigned to her by her elliptical Motion in the Lunaris, and expreſſed by the Epicycle's Center.

§XXX. Would we go further, and expreſs the next following Revolution, it is plain, that *the Moon would deſcribe another Curve*, and deviate differently from what it is repreſented in the Figure within : and without : the Lunaris ; anteceding, and following differently the Points in the Lunaris, aſſigned to her by her elliptical Motion in the ſame.

§XXXI. And ſo on ſucceſſively in other following Revolutions.

The Curves, which the Moon deſcribes, and the Motions, by which ſhe moves, are in a perpetual Change.

§XXXII. Therefore, we muſt conſider *the Curves, which the Moon deſcribes by her Revolutions*, and *the Motions, by which ſhe moves* ; to be *in a perpetual Change.*

(2.) What Point is meant by the Center of the Lunaris, deſcribing the Geocentric.

XXXIII. I have ſaid in the 5th §. *that the Center of the Lunaris deſcribes the Geocentric.* Yet, we cannot underſtand this otherwiſe, but, as *in a mean Meaning.* Becauſe, it is not the true Center of the Lunaris in the croſſing of the greater and leſſer Axis ; but, *a Point in the leſſer Axis*, (conſequently none of the Focus's, which are in the greater Axis's), more diſtant from the Sun, than the true Center, *which deſcribes the Geocentric* ; repreſented in the ſecond Figure by the Spot between the true Center and α ; which Point I call THE MOVING CENTER.

The moving Center.

(3.) The moving Center deviates within : and without : the Geocentric.

§XXXIV. Neither can we ſay, that the ſaid Moving Center deſcribes the Geocentric, but *in a mean Meaning.* Becauſe, as the Moon deviates within : and without : the Lunaris, ſo the Moving Center deviates within and without the Geocentric.

Theſe Deviations explained by an imaginary Epicycle.

§XXXV. I find theſe Deviations, by Aid of *an imaginary elliptical Epicycle, placing its Center in* the Geocentric, where the moving Center would be in the ſame, by its elliptical Motion, ſuch as deſcribed in the 10th § ; ſuppoſing *its Poſition ſuch, that its greater Axis is in a Right-Line from the Geocentric's Center, through the Center of the Epicycle.* Where I call *the Epicycle's Apſis* that Point in the Epicycle which is interſected by the ſaid Right-Line, after having paſſed the Epicycle's Center.

§ XXXVI. Now I ſuppoſe from Obſervations, *the mean Elongation of the moving Center from the Apſis in Conſequentia, to be double, to what the Elongation of the mean Apogee is from the mean Aſcending Node in conſequentia — 3 Signs.* Wherefore, *doubling the mean Elongation of the mean Apogee from the mean aſcending Node, and ſubtracting therefrom 3 Signs,* it gives *the mean Elongation of the moving Center from the Epicycle's Apſis in Conſequentia.*

§ XXXVII. But ſuppoſing, the imaginary Motion of the Moving Center in the Epicycle, to be an elliptical one, ſuch as deſcribed in the foregoing 10th §, the Equation for ſuch is to be obſerved, if we deſire to have the equated Elongation from the Apſis.

§ XXXVIII. If we place *the Center of the Epicycle*, in the Geocentric, according to the 35*th* §, and *the moving Center in the imaginary Epicycle*, *according* to the 36th and 37th §', it will appear, *when and how the Moving Center deviates within* : *and without* : *the Geocentric* ; and *when and how it antecedes or follows that Point in the Geocentric*, *aſſigned to it by its elliptical Motion*, and expreſſed by the Epicycle's Center.

§ XXXIX. The third Figure will make the Matter more plain; in which *the lineated Curve repreſents the Geocentric*, (which in the firſt Figure is repreſented by the Curve a. a. a, but here repreſented greater.). I ſhall not trouble my ſelf with the Equation, concerning the moving Center's elliptical Motion *in the Epicycle*; becauſe it not being poſſible to expreſs in the Figure the Difference in the Epicycle between the mean, and elliptical Motion.

§ XL. The greater Axis α. ε. is in the Right-Line from the Center of the Earth's Orbit through the Earth S. α, ε.

Apocenters.

§ XLI. This greater Axis being in the ſaid Right-Line, the Apocenters are alſo in the ſame, (I call *Apocenters in Ellipſis's thoſe Points, which are interſected by the greater Axis*); and the one of the Apocenters being remoter from the Sun, than the other, I call that, what is remoteſt, *Apocentrum Aphelium.*

§ XLII. This Apocentrum Aphelium I take for *terminus a quo*, counting from thence the Elongation of the moving Center in antecedentia (α).

(α) Though the Center of the Lunaris moves as the Apogee, and therefore in conſequentia, yet the moving Center, conſidered in the Geocentric Elongates from the Apocentrum Aphelium in Antecedentia; becauſe, the Apocentrum Aphelium of the Geocentric moves by the Motion of the Longitude of the Earth quicker, than the moving Center by the Motion of the Apogee.

§ XLIII. Now ſuppoſe, the Earth to be in its mean Place, *the Apocentrum Aphelium of the Geocentric*, (being in the ſaid Right-Line), *muſt coincide with the mean Longitude of the Earth.*

§ XLIV. Let *the Moon's mean Apogee be in Conjunction with the mean Longitude of the Earth*, and the moving Center (conſidered in the 8th §, to move by the Apogee) would be in the Apocentrum Aphelium of the Geocentric. Therefore I place the Epicycle's Center in the ſaid Apocenter; as ſhewn by the Right-Line from the Center of the Geocentric through α; and the Apſis muſt be in the ſame Right-Line, according to the 35th § aforegoing.

§ XLV. But let *the ſame Moon's mean Apogee be elongated from the Moon's mean aſcending Node Sign* 1. 15. 0. 0. *in conſequentia.*

§ XLVI. Now, according to the foregoing 36th §, *the Elongation of the moving Center from the Apſis in conſequentia*, is, *double, what the Elongation of the Moon's mean Apogee from the mean aſcending Node in Conſequentia*, — 3 Signs. The Elongation of the Moon's mean Apogee from the mean aſcending Node is taken in the next foregoing § for Sign 1. 15° 0′ 0″, This doubled is Sign 3. 0. 0. 0. This — 3 Signs is nothing. Therefore, the moving Center will be, not diſtant from, but in the Apſis, in conſequentia; as marked with the Spot.

§ XLVII. Let the mean Longitude of the Earth have advanced from the Moon's mean Apogee 45 Degrees in conſequentia,

ſequentia, and the moving Center will be elongated in the Geocentric from the Apocentrum Aphelium by its mean Motion 45 Degrees, but by its elliptical Motion not but about 33 Degeees in antecedentia. Therefore I place the Center of the Epicycle in the Geocentric under the Angle of 33 Degrees from the Apocentrum Aphelium in antecedentia, as ſhewn by the Right-Line from the Center of the Geocentric through β.

§ XLVIII. In the mean while, that the mean Longitude of the Earth advances 45 Degrees in conſequentia, the Moons mean Apogee advances 5° 5′ 11″ in conſequentia, and the Moon's mean aſcending Node 2° 25′ 4″ in antecedentia. Wherefore, the Elongation of the mean Apogee from the mean aſcending Node for the ſaid Time, is 7° 30′ 15″, in conſequentia.

§ XLXIX. In the 45th § the Elongation of the mean Apogee from the mean aſcending Node is ſuppoſed Sign 1. 15. 0. 0. and in the next foregoing § it is for the ſaid Time Degree 7. 30. 15. Therefore it muſt now be Sign 1. 22. 30. 15. This doubled is Sign 3. 15. 0. 30; and Sign 3. 15. 0. 30.—Sign 3. 0. 0. 0. is Sign 0 15. 0 30. Therefore, *the moving Center will be from the Apſis Degrees* 15. 0. 30. *in conſequentia*; as marked with the Spot.

§ L. If we will go on in the ſame Manner, placing the Epicycles, where the moving Center would be in the Geocentric by its elliptical Motion, after the mean Longitude of the Earth has advanced other 45 Degrees, and again other 45 Degrees, &c. the moving Center would be.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Geocentric through γ from its Apſis about 30° 1′ 0″, in conſequentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right Line from the Center of the Geocentric through δ, from its Apſis about 45° 01′ 30″, in connſequentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Geocentric through ε, from its Apſis about 60° 2′ 0″, in antecedentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Geocentric through ζ, from its Apſis about 75° 2′ 30″, in conſequentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Geocentric through η, from its Apſis about 90° 3′ 0″, in conſequentia; as marked with the Spot.

In the imaginary Epicycle, ſhewn by the Right-Line from the Center of the Geocentric through θ, from its Apſis about 105° 3′ 30″, in conſequentia; as marked with the Spot.

In the imaginary Epicycle, from which we did begin, and ſhewn by the Right-Line from the Center of the Geocentric through α, from its Apſis about 120° 4′ 0″, in conſequentia; as marked with the Spot.

§ LI. Let us bring theſe Points, where the moving Center is ſuppoſed to be in the repreſented Epicycles, in one Curve, and *the moving Center in the ſuppoſed Revolution would have deſcribed the pointed Curve*, deviating within : and without : the Geocentric, anteceeding and following alſo the Points aſſigned to it by its elliptical Motion, and expreſſed by the Epicycle's Centers.

§ LII. Would we go further, and expreſs the next following Revolution, it is plain, that *the moving Center would deſcribe another Curve*; and deviate differently from what is repreſented in the Figure within : and without : the Geocentric; anteceeding or following differently the Points in the Geocentric, aſſigned to it, by its elliptical Motion in the ſame.

The Curves, which the moving Center deſcribes, and the Motions, by which it moves, are in a perptual Change.

§ LIII. And ſo on ſucceſſively in other following Revolutions.

§ LIV. Therefore, we muſt conſider *the Curves, which the moving Center deſcribes by its Revolutions*; and *the Motions, by which it moves*, to be *in a perpetual Change*.

(β) The Motions of the Lunar Syſtem.

§ LV. I have in the 6th § deſcribed the Poſition of the lunar Syſtem ſuch, that *its diametral Line coincides with a Right-Line from the Center of the Earth's Orbit through the Earth*. But, we cannot take this otherwiſe but as *the lunar Syſtem's mean Poſition*.

§ LVI. For, *Equations* are required in the lunar Calculus's, which have no reſpect to the Moon, but are *the ſame, where ever the Moon is in the Lunaris.*

§ LVII. Which to explain, we may ſuppoſe, *the lunar Syſtem's diametral Line to turn*, viz. *upon the lunar Syſtem's Center, by a libratory Motion*, from the Right-Line, drawn from the Center of the Earth's Orbit through the Earth, at one Time in conſequentia, and at another in antecedentia; by which *the whole lunar Syſtem muſt turn by the conſtant Poſitions* of the Geocentric, and the Lunaris, in reſpect to the diametral Line, as deſcribed in the 7th §; and conſequently *repreſent the Moon, where ever ſhe is in the Lunaris, according as the lunar Syſtem has turned.* See the fourth Figure, where D. L. repreſents the diametral Line turned in conſequentia from the Right-Line from S through E.

§ LVIII. And this is *the Idea of the Motions, which ſingly have Reſpect to the lunar Syſtem*, where are conſidered *firſt* the Motions in the Lunar Syſtem, and *ſecondly* the Motions of the lunar Syſtem.

(II).
The Motions which have Reſpect to the Ecliptic.

§ LXIX. Now, I ſhall conſider *the Motions, concerning the lunar Syſtem, which have Reſpect to the Ecliptic.* Where we are acquainted, that *the lunar Syſtem's Plane keeps not always one and the ſame Poſition with the Ecliptic's Plane, but alters it ſucceſſively.*

The Nodes, made by the Interſections of the Moon's Plane, with the Ecliptic Plane.

§ LX. For, though the Moon's Plane interſects always the Ecliptic's Plane in two Points, oppoſite to one another; yet *theſe Interſections* called NODES, *are not always in the ſame Points of the Ecliptic; neither are the Angles at the Interſections always the ſame.*

Parallel Axis.

§ LXI. To explain theſe Things, I ſuppoſe an Axis thro' the Earth, parallel to the Axis of the Earth's Orbit, that is parallel to the Axis of the Ecliptic; which hereafter I call *the parallel Axis*; in the ſixth, ſeventh, and eighth Figures marked with P. A.

§ LXII. I ſuppoſe further, an Axis through the Earth, at Right Angles with the lunar Syſtem's Plane, this Plane being marked in the Figures L. Pl. This Axis, croſſing the afore-ſaid parallel Axis in the Earth, I call hereafter *the lunar Axis*, marked in the ſaid Figures l. a; and the Poles of the lunar Axis I call *lunar Poles*.

Lunar Axis.

Lunar Poles.

§ LXIII. Now, I ſuppoſe, *the lunar Poles to move round the ſaid parallel Axis in antecedentia*, and to deſcribe, (at both Poles), Curves, which might ſeem to be Ellipſis's (becauſe, not only all Curves in the planatory Motions, we are acquainted with, but alſo, all thoſe, hitherto conſidered in the Moon's Motions, are ſuch), whoſe greater Axis may ſeem to coincide with that Meridian, which paſſes through the Poles both of the Ecliptic, and of the Equinoctial. But, as they ſeem to come near Circles, I ſhall take them for Circles, and call them *Axicycles*; viz. deſcribed by the Axis of the lunar Syſtem.

Axicycles.

§ LXIV. Now, it is clear, that *the lunar Syſtem's Plane, muſt make the ſame Angles with the Ecliptic's Plane, as the lunar Axis makes with the parallel Axis*, cauſing the ſo called *Inclination of the lunar Orbit*; or, as it might be called, *the Latitude of the lunar Syſtem*. See the ſaid Figures.

§ LXV. It is clear, that *as the lunar Poles move in the Axicycles, ſo the Interſections, or Nodes muſt move in the Ecliptic*.

§ LXVI. And it is alſo clear, that *the Interſections of the lunar Syſtem's Plane with the Ecliptic's Plane, muſt be in the Quadratures with the lunar Poles*.

§ LXVII. But the ſaid Axicycles cannot be conſidered, but *as mean Curves of the Motions of the lunar Poles*; becauſe, as the Moon and the Geocentric deviate each within : and without : its Curve; and antecede or follow the Points, aſſigned to them by their elliptical Motion, ſo (1) the ſaid Poles deviate within : and without : the Axicycles. (See the fifth Figure, repreſenting an Arch of an Axicycle); and conſequently, *ſo the Angles at the Nodes made by the lunar Plane with the ecliptic's Plane will be greater or leſſer*. (See the

Lunar Poles deviate within : and without : the Axicycles.

the ſixth Figure, where the parallel Axis is repreſented juſt in the Axicycles; the ſeventh, were moſt without; and the eighth, were moſt within the ſame).

§ LXVIII. And ſo (2) *the ſame Poles will antecede or follow the Points, aſſigned them, by a ſuppoſed equal Motion of the Poles in the Axicycles.* (See the ninth Figure, where a lunar Pole is at the Spot in the repreſented Epicycle, inſtead of being, where the Epicycle's Center is; and, the Poles will not be in the Quadratures with the Center of the Epicycle, or in the Diameter 1. 1; but they will be in the Quadratures with the Spot in the Epicycle, and at the Spots near the ſaid Diameter 1. 1.)

TheſeThings explained by an imaginary Epicycle.

§ LXIX. I find the true Points, where the Poles of the lunar Symſtems are, by aid of *imaginary Epicycles*, &c. (of which the ſeventh, eighth, and ninth Figures have already given ſome Idea); and theſe I ſuppoſe *Ellipſis's, and their Poſitions thus; that their greater Axis's are in a Right-Line from the Centers of the Axicycles through the Centers of the Epicycles.*

§ LXX. I place the Centers of theſe imaginary Epicycles in the Axicycles, where the lunar Poles would be by the Motion of the mean aſcending Node, that is, in the Quadratures with the ſame.

§ LXXI. I draw Right-Lines from the Centers of the Axicycles, through the Centers of the imaginary Epicycles; and call *Apſis's*, the Points in the Epicycles interſected by the ſaid Right-Line, after having paſſed its Center. See the fifth Figure.

§ LXXII. Then I ſuppoſe, that *the lunar Poles are in the Epicycles Apſis's, when the mean Longitude of the Earth is in Conjunction, with the Moon's mean aſcending Node; and again, when in Oppoſition; and to move in conſequentia.*

§ LXXIII. From which, *the Elongation of the ſaid Poles from the Epicycle's Apſis's in conſequentia*, muſt be, *double*, to *what the mean Elongation of the Longitude of the Earth is from the mean aſcending Node.*

§ LXXIV. Now, becauſe, the Plane of the lunar Syſtem muſt make the ſame Angles with the Ecliptic's Plane, according to the 64th §, which the lunar Axis makes with the parallel Axis; *the Angles of the lunar Plane with the Ecliptic Plane muſt be greateſt, when the lunar Poles are in the Apſis's*, that is, when the mean Longitude of the Earth is in the Conjunctions (☌ ☍) with the mean aſcending Node. (See the ſeventh Figure); And *the ſaid Angles muſt be leaſt when the lunar Poles are oppoſite to the Apſis's*, that is, when the mean Longitude of the Earth is in the Quadratures with the mean aſcending Node. (See the eighth Figure). And in both theſe Caſes, there muſt be *no Equation of the aſcending Node*; becauſe, that the Apſis's, and their oppoſite Points, are then in the Right-Line from the Centers of the Axicycles, through the Centers of the Epicycles.

§ LXXV. Again, becauſe, that the Interſections, or Nodes muſt move in the Ecliptic as the lunar Poles move in the Axicycles according to the 65th §, *the ſaid Nodes muſt move by their mean Motion in antecedentia*, (by Reaſon, the lunar Poles move in antecedentia in the Axicycles, according to the 63d §); but *by their true Motion antecede at one Time, and follow at another Time, the Points, where they are placed by their mean Motion*, according as the lunar Poles in the Epicycles, antecede or follow the Epicycle's Centers. (See the 9th Figure) Wherefore, *the greateſt Equation of the aſcending Node, to be added*, muſt be, when the lunar Poles are from the Epicycle's Apſis's 3 Signs in conſequentia; that is, when the mean Longitude of the Earth is in the 1ſt, and 3d Octant from the mean aſcending Node; and *the greateſt Equation, to be ſubtracted*, muſt be, when the lunar Poles are from the Epicycle's Apſis's 9 Signs in conſequentia; that is, when the mean Longitude of the Earth is in the 2d and 4th Octant from the mean aſcending Node; and in theſe Caſes, *the Angles of the lunar Plane with the Ecliptic's Plane muſt be the Mean between the greateſt, and leaſt*, becauſe, the lunar Poles are then in the Axicycle's. (See the 6th Figure).

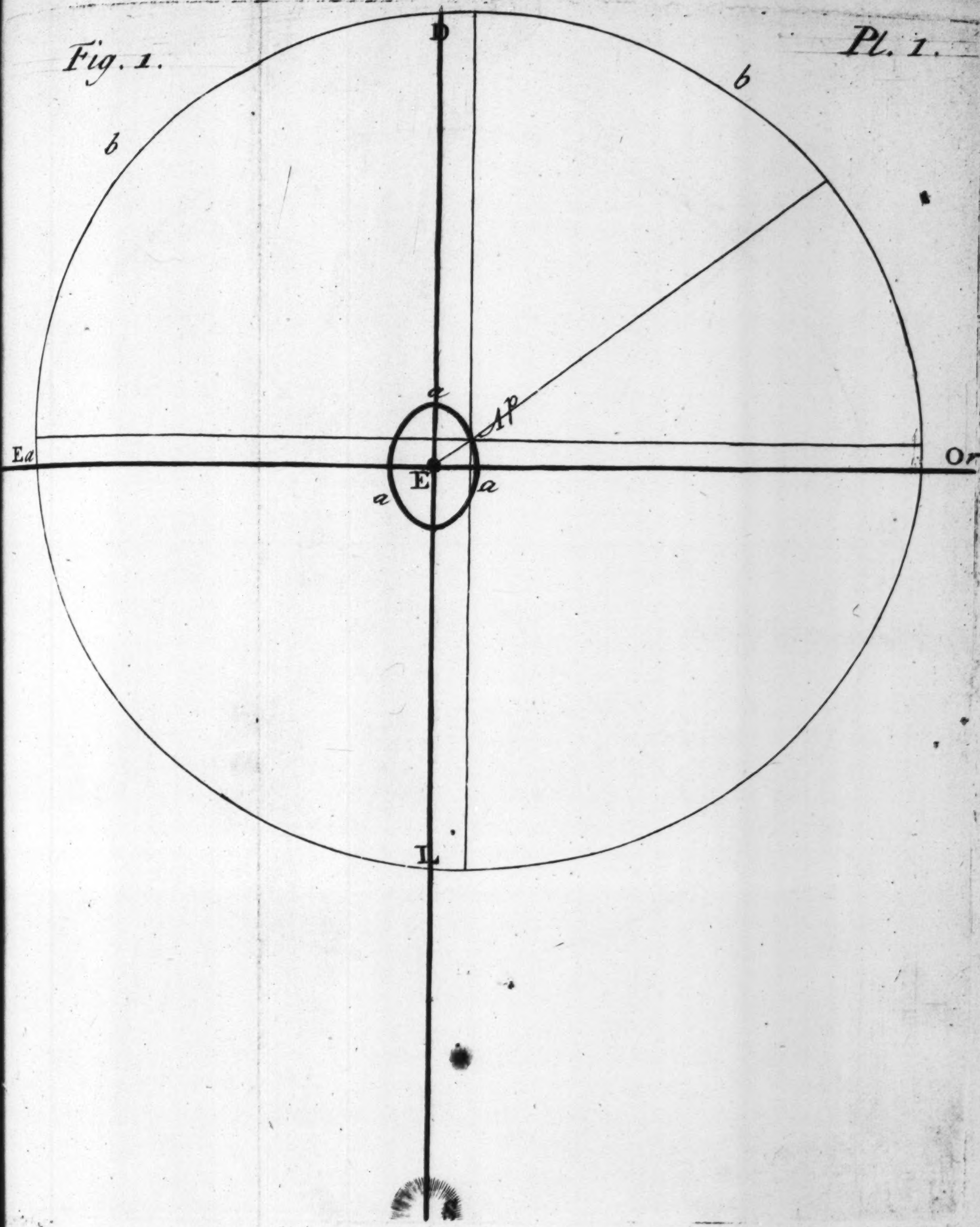
§ LXXVI. And, becauſe, that the Interſections of the lunar Syſtem's Plane with the Ecliptic's Plane muſt be in the Quadratures, with the lunar Poles, according to the 66th §, *the Nodes muſt be oppoſite in the Ecliptic to one another*.

§ LXXVII. And this is *the Idea, of the Motions of the lunar Syſtem, which have Reſpect to the Ecliptic.*

§ LXXVIII. I deſign not to engage my ſelf in an Inquiry after Phyſical Reaſons for the ſaid Motions; leaving this to ſuch, who will pleaſe to meditate upon this Matter, But I will endeavour to find a rational Calculation from the Principles laid down, which may nearly agree to Obſervations, explaining diſtinctly what Equations concern the Motion of the Moon, and what her Aſpect from the Earth. And this will be the Subject, of the following Second Part.

Read in Page 1, Line 5, *for* Revolations, Revolutions.

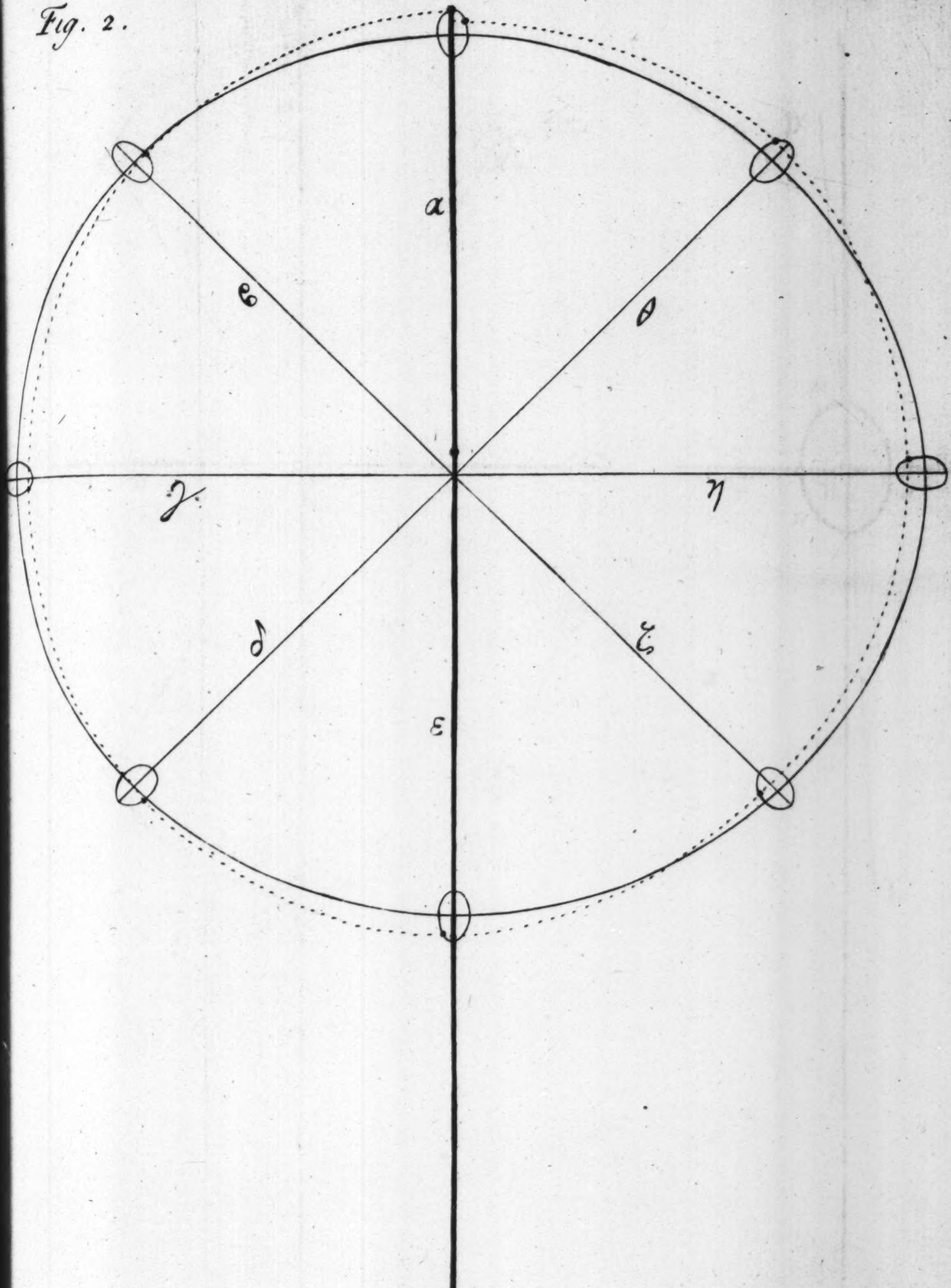
Fig. 1. Pl. 1.

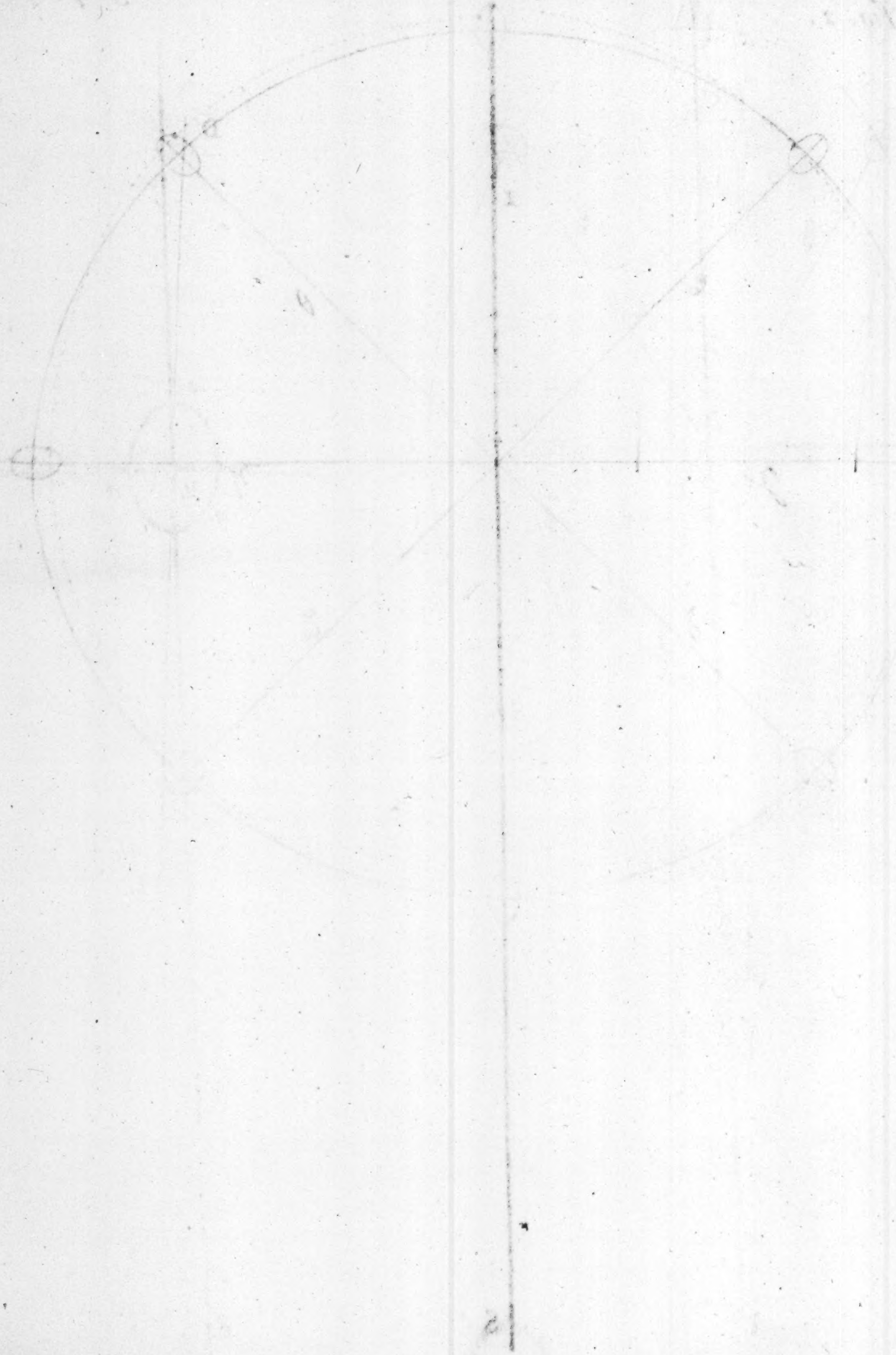


Ea. Or. An Arch of the Earth's Orbit.

Pl. 2.

Fig. 2.





Pl. 3.

Fig. 3.

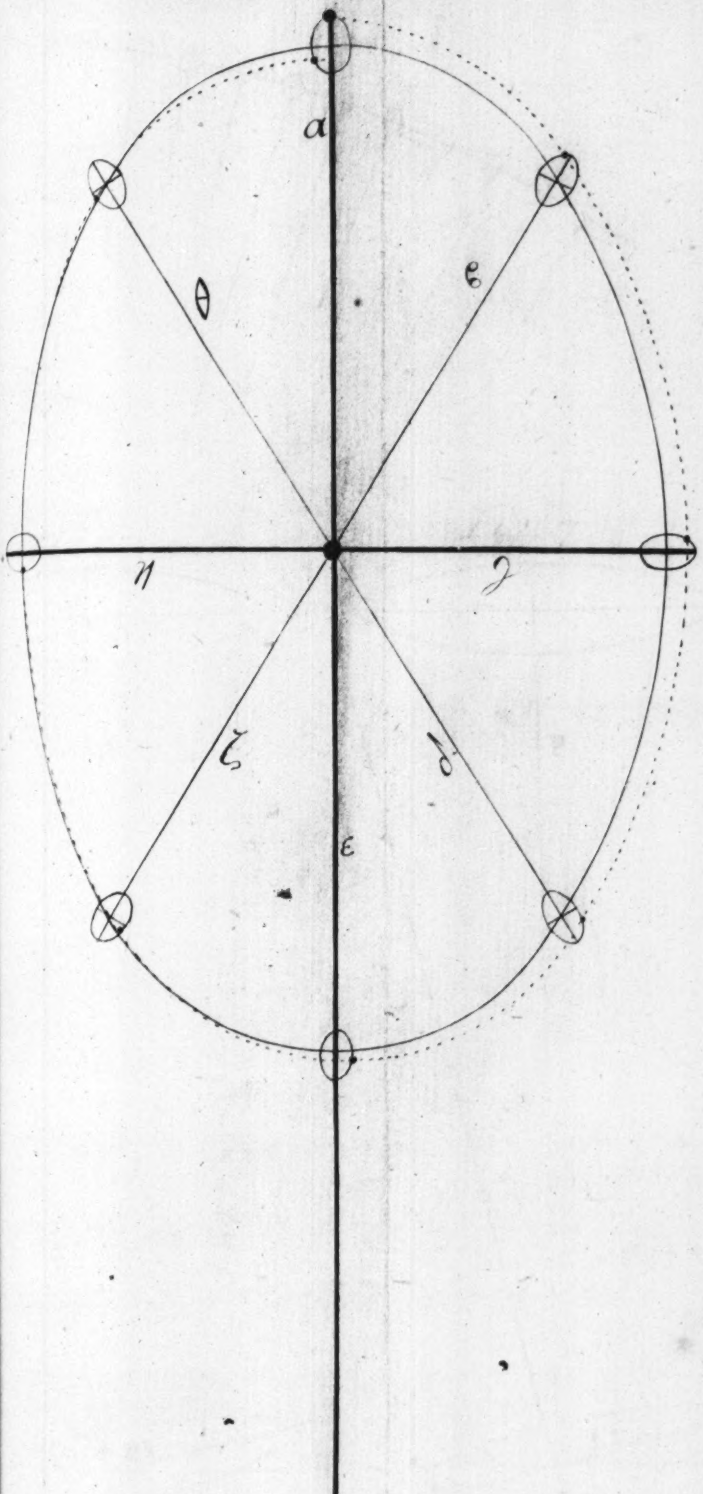


Fig. 4.

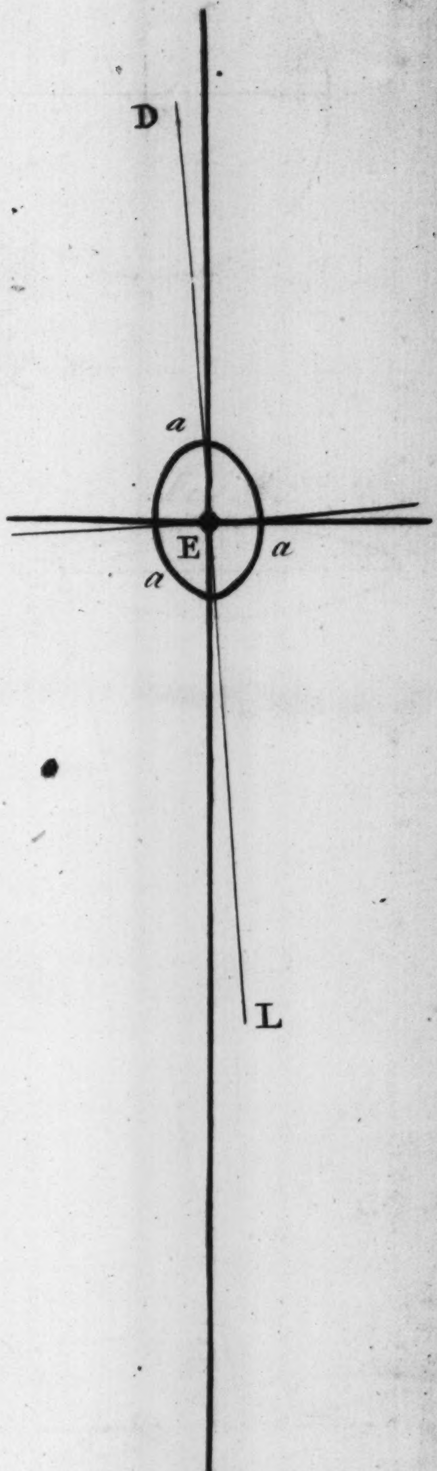
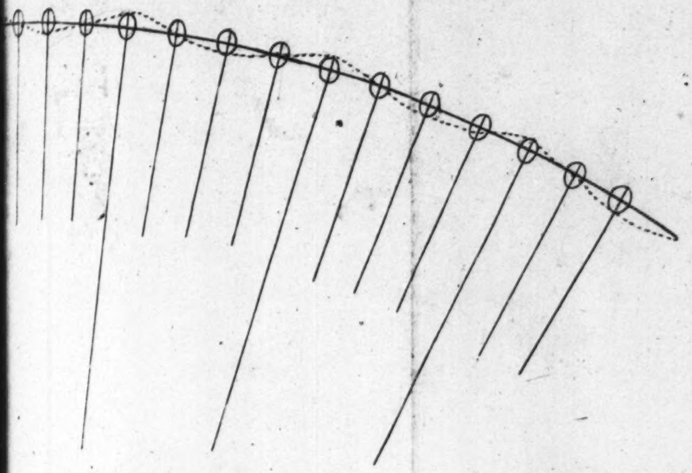


Fig. 5.



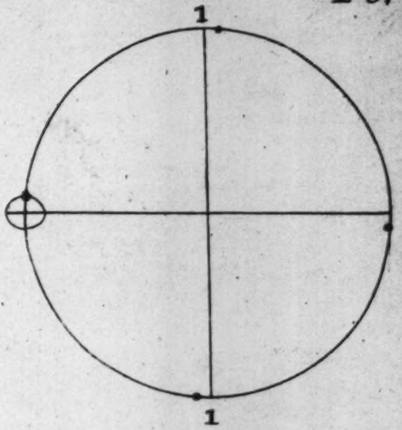


Fig. 9.

Fig. 6.

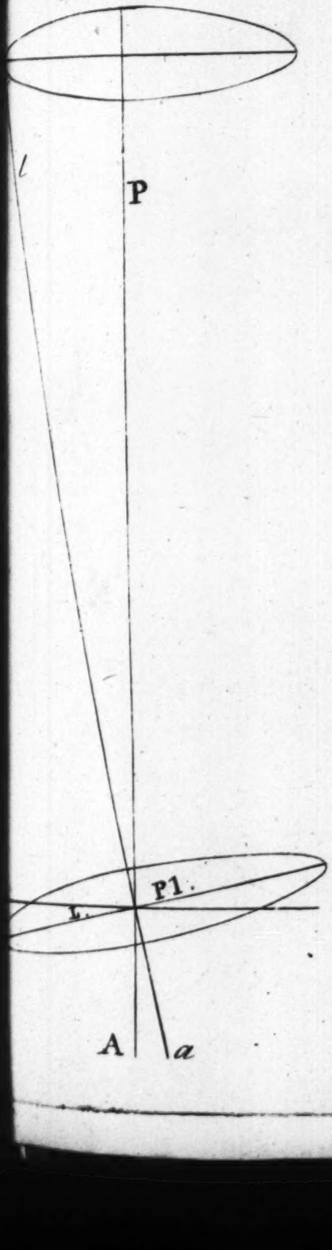


Fig. 7

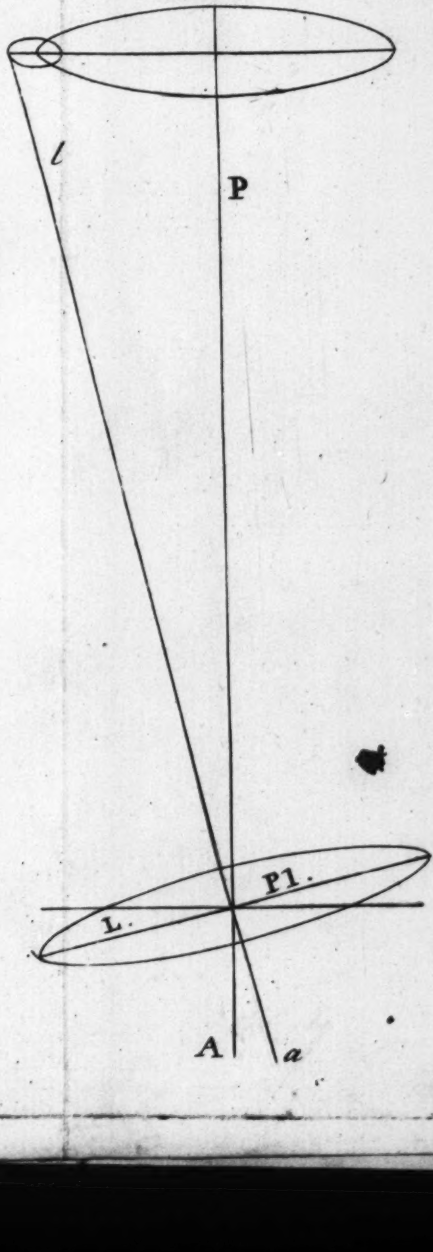


Fig. 8.